7. MSS HWCI

The MSS Hardware CI (MSS-MHWCI) is the hardware to host all MSS software described in Sections 3 through 6. The MSS-MHWCI logically includes an enterprise monitoring server, a local management server, and a management workstation. The selection of these configurations are the culmination of requirements analysis, trades analysis, and analysis with specific focus on performance, RMA, security and evolvability considerations. *Note that the rationale for the sizing of the MSS HWCI, which is specific to each DAAC, is in the DAAC-specific portions of this document.*

7.1 MSS-MHWCI Design Drivers

Major design drivers for management subsystem hardware include the number of managed objects, size and frequency of data to be collected about managed objects, data distribution (between the DAACs and the SMC), data retention policy and archiving design, and COTS choices. In addition, Table 7.1-1 lists the Level 3 requirements that specifically drive the MSS hardware design:

Table 7.1-1. MSS Hardware Requirements Drivers

Requirement Number	Summary	MSS H/W Impact
EOSD 0030	Archive of EOS and related non-EOS data and products	Sizing assumptions of management data holdings
EOSD 3200	Minimum one backup in separate physical location for ECS software and key data items	MSS database partitioning/ replication schemes
EOSD 3700	ECS functions Ao of 0.96 (.998 design goal) and MDT of four (4) hours (1.5 hour design goal)	Overall RMA design of hardware strings
EOSD 4030	SMC function Ao of .998 (.999998 design goal) and MDT of 20 minutes (5 minutes design goal	Overall MSS design of EMC and LSM
SMC-0300	100 percent growth in SMC processing speed without modifications or upgrades to software	Sizing and scaleability
SMC-0310	100 percent growth in SMC storage capacity without modifications or upgrades to software	Sizing and scaleability

7.1.1 Key Trade-off studies and Prototypes

Table 7.1-2 lists trades and prototypes that have provided input to the MSS hardware design.

7.1.2 Sizing and Performance Analysis

This section discusses the method of sizing the MSS hardware at the DAACs and the SMC. Specific sizing calculations, on a per-site basis, are included in the DAAC unique design documents. The MSS HWCI configuration includes both the MSS and CSS server software (a redundant configuration to enable warm backup); however, this section only describes analysis of the MSS requirements. The complete configuration of the MSS and CSS HWCIs, based on the

combined requirements of the subsystems, are presented in the site-specific documents. Additional detail on the analysis of the CSS HWCI sizing and performance is contained in the CSS document.

Table 7.1-2. Key Trades and Prototypes

Trade	Conclusion / Result	Impact
Management Data Archive Trade (540-TP-001-001)	Use data server archive for long-term storage of MSS data	Eliminates need for separate large MSS storage.
Common DBMS Server (540-TP-001-001)	Offload DBMS server functionality to the MSS workstations.	Size the CPU of the MSS workstations to account for workstation offload of DBMS
Management Agents / Protocol Selection (540-TP-001-001)	SNMP protocol will be used, with MIB-II and extensible agents	Performance and sizing model inputs
Selection of Management Framework Product (540-TP-001-001)	HP Openview will provide the management framework	Performance and sizing model inputs

7.1.2.1 Processing Analysis

The processing requirements for the MSS HWCI are driven by the following types of transactions:

- HP Openview data collection, displays, and ad hoc queries
- Tivoli/TME data collection and Display
- Conversion / import of HP Openview and log file data to MSS Sybase DBMS
- DBMS usage for report generation / ad hoc queries
- Fault & performance management notification
- Trouble ticketing
- Request tracking
- Billing & Accounting
- Mode management
- Resource Planning
- Usage for configuration, baseline, training, license, inventory/logistics/maintenance, change request, software distribution, and associated report generation

HP Openview data collection transactions were calculated, based on the number of managed objects, the number of MIB attributes to be monitored, and the frequency of data collection. Based on an estimate provided by HP of approximately 1K instructions per monitoring transaction, the number of MIPs required for an HP Openview data collection was estimated. Estimates of HP Openview requirements for display, query, and reporting functions were based on experience in the EDF (EP3 and EP4), and HP estimates of host requirements. The total estimate of processing capacity and RAM required does not vary significantly by DAAC, since data collection represents only a part of the processing requirement.

Conversion and import of HP Openview and log file data to the MSS DBMS was based on the amount of data to be imported and the amount of intermediate processing required for each data item. The amount of processing of each log file and HP Openview record was based on the number of lines of code in the MSS Management Data Access component responsible for data conversion, and an estimate of Sybase update complexity. The number of log files to be processed was based on the number of system transactions throughout the DAAC. Pull transactions were based on user model estimates of the number of directory, inventory, browse, tracking requests, information tracking of billing & accounting user accounts and other service requests per DAAC. An average of twenty 128 to 256 byte log entries is assumed per pull transaction, including log entries generated by CIDM and data server. Log entries will also be generated by push transactions, including PGEs (estimated 2 entries per PGE), archive requests (estimated 4 entries per request), and external data transfers (estimated 4 entries per transfer). A worst-cast assumption was made that all data collected on a regular basis will be imported to the DBMS, and that 10% of the data requires additional summarization. The overhead required to provide mode management capability is estimated at 30% of the total logged activity.

Use of Sybase for ad hoc queries, analysis and report generation will exert a moderate (but sporadic) load on the MSS server. The estimate of Sybase client and server requirements was based on vendor recommendations and analysis of DBMS benchmarks in the EDF.

M&O usage of CM tools, the trouble-ticketing system, fault & performance management monitoring (HP Openview/Tivoli), billing & accounting, mode management and utilities (word processor, spreadsheet, graphics) are expected to exert a moderate load on the MSS hardware. Estimates were based on vendor-provided information and experience in the use of these products (e.g., Clearcase) in the EDF. COTS applications and custom code will be distributed among the MSS hardware to assure proper load balancing.

MSS HWCI requirements were then combined with those of the CSS DCHCI to develop an aggregate profile for SMC and LSM servers. Based on the combined requirements of CSS and MSS, medium to high end servers will be used at both the DAACs and the SMC. Processing requirements were analyzed for both Release A and Release B estimates of the number of managed objects. The choice of processors was based on the need to handle Release B loads.

7.1.2.2 Storage Analysis

Major CSMS datastores were analyzed for all sites in the Release B timeframe. MSS data stores analyzed included

- HP Openview internal data storage
- Log files (collected from monitored processes and includes contributions from request tracking, billing & accounting and mode management)
- Sybase database (derived from data in HP Openview and log files)
- Clearcase data storage, for ECS software, configuration files, and test data
- Internal data storage for other MSS COTS, including the trouble ticketing system, performance management (Tivoli), the change request manager (DDTS), the baseline manager (XRP) , inventory/logistics/maintenance management, software license management, training management, policy & procedures, performance trending and report generation

HP Openview data storage was based on the number of managed objects, the number and size of MIB attributes to be monitored, HP Openview storage overhead, the frequency of data collection for each attribute, and an assumption of 14 days of rolling storage at a time.

Required storage for log files was based on the number of distributed logs to be collected (based on the number of active processes at each DAAC) and the amount of data in each (based on the number of system operations that cause logs to be created). Data maintained in log files addresses needs for performance, fault, accountability and security. Transient processes (e.g., in the production subsystem) are assumed to provide a minimum of two log entries of 128 bytes each, to indicate the initiation and completion of the process. Non-transient processes provide a 128 byte log entry each time they process a new request (e.g., a file archive request). In addition, major system processes are monitored (polled) at 15 minute intervals, with each polling request generating approximately 512 bytes of data.

A gross estimate of the Sybase database was developed using a worst-cast assumption that all data collected on a regular (i.e., with determined frequency, vs. ad hoc) basis is kept in the DBMS, with an additional 10% for summarized fields and data to be maintained in more than one table (e.g, data relevant to multiple MSS services). The estimate assumed that the DBMS would maintain one month of data at one time, in order to be able to examine medium term trends affecting the DAAC.

Storage required for Clearcase managed data at each DAAC was based on estimates of ECS source custom lines of code, algorithm source lines of code, executables, configuration files and scripts, and test data.

Other COTS products are expected to require a minor amount of storage at each DAAC and the SMC. An estimate of the storage required each product was based on vendor specifications for record sizing and estimates of the number of records required for each (e.g., for the change request manager, an estimate of the number of CCRs per month, DRs per month, and NCRs per month).

In addition, CSS DCE datastores (DCE directory and security information bases) will be replicated on the MSS server to ensure high availability of CSS DCE services. Estimates for these stores were added to the MSS requirements to determine the overall disk sizing.

7.1.3 Scalability and Evolvability

At Release B, several sizing parameters increase. Increased number of user requests, PGEs, and file archive requests all affect the number of log entries that are collected by the MSS server. An increase in the overall number of managed objects will increase the amount of HP Openview data collection. Increases in the number of log entries and the amount of HP Openview data collection drive the amount of processing needed to import data to the MSS DBMS, and also increase the volume of network traffic over the DAAC LANs.

CPU and RAM for the CSS and MSS servers were sized to accommodate Release B processing and memory requirements at all DAACs and the SMC. RAID storage was sized based on datastore analysis, vendor recommendations and product experience. Sizing of network loads through Release B indicates that FDDI will be adequate at the SMC and the DAACs.

7.2 HWCI Structure

The MSS-MHWCI contains the following components:

- Enterprise Monitoring Server
- Local System Management Servers
- Management Workstations
- PCs (SMC only for billing & accounting client)
- Printers

7.2.1 Connectivity

Each DAAC's LSM will reside on a separate FDDI ring, with connectivity to the rest of the DAAC provided by a redundant FDDI switch/router. The MSS Local Management Server will be equipped with a DAS (dual-attached station) card that is connected to two FDDI concentrators, providing redundancy in the event of a concentrator failure. The MSS monitoring workstations and SMC dedicated PCs will be equipped with an SAS (single-attached station) interface card, connected to a single FDDI concentrator.

The SMC will reside on a separate FDDI ring at GSFC. Both the Enterprise Communications Server and Enterprise Management Server will be connected to dual FDDI concentrators via DAS interfaces; management workstations, PCs and printers will be connected to a single FDDI concentrator via an SAS interface.

Overall network connectivity at each site is discussed in the Release B Overview Design Specification (305-CD-020-001); specific configurations for each site are presented in the site-specific documents.

7.2.2 HWCI Components

The MSS-MHWCI monitoring / management server, provided at each DAAC and the SMC, is the primary server for MSS applications and data. It is cross-strapped to the CSS-DCCI communications server (see Figure 7.2-1) to provide for failover (warm standby) capability, and is populated with the MSS-MCI monitoring configuration, the MSS-MLCI logistics monitoring configuration, the MSS-MACI system management agent configuration, and the CSS-DCCI client and server configurations. The MSS-MCI monitoring configuration includes management applications (e.g., HP Openview, Tivoli, Trouble Ticket), common management services (e.g., Sybase, wordprocessing, and spreadsheet packages), and managed object template services software.

The MSS-MHWCI management workstation configurations are networked workstations at every ECS site that support all aspects of enterprise management between the M&O staff and the SMC/ LSMs. The MSS-MHWCI management workstations are populated with the CSS-DCCI client configuration, the MSS-MACI systems management agent configuration, and user-selected subsets of the MSS-MCI enterprise monitoring configuration software and data.

The MSS-MHWCI PC configurations are located only at the SMC and dedicated for billing & accounting purposes. The PCs will be networked and running on a network operating system (i.e. Microsoft Windows NT). Specific billing & accounting functions performed will include maintaining of the general ledger and financial reporting.

The MSS-MHWCI printers are printers at each site for general administrative purposes, and a specialized printer (e.g., impact) at each site to print passwords through sealed envelopes for password administration purposes.

7.2.3 Failover and Recovery strategy

Analysis of failover strategies supports the integration of the CSS and MSS servers to serve as warm standby to each other, cross-strapped to RAID devices for critical data access by either server. The DCE logical server functions will be replicated and active on the MSS server. MSS logical server functions will be configured but inactive on the CSS server. In the event of a failure of either server, the second RAID can be mounted for use by the backup server. A copy of all management data will be stored in RAID and backed up via the backup server on a daily basis and routinely safestored in the ECS data server archive. Data for the real time logical server functions (i.e. HPOV, Tivoli, Billing & Accounting) will be preserved through methods of disk mirroring, data replication and storage of transaction logs (Billing & Accounting).

The LSM is designed to continue to function in the event of an EMC failure, and agents at hosts will continue to monitor managed objects in the event of an LSM failure. Dual attached FDDI within the local DAAC LAN designs for critical RMA links.

Specific calculations of reliability and availability of MSS components are provided in 516-CD-002-001, Reliability Predictions for the ECS Project (October 1995), and 518-CD-002-001, Maintainability Predictions for the ECS Project (October 1995).

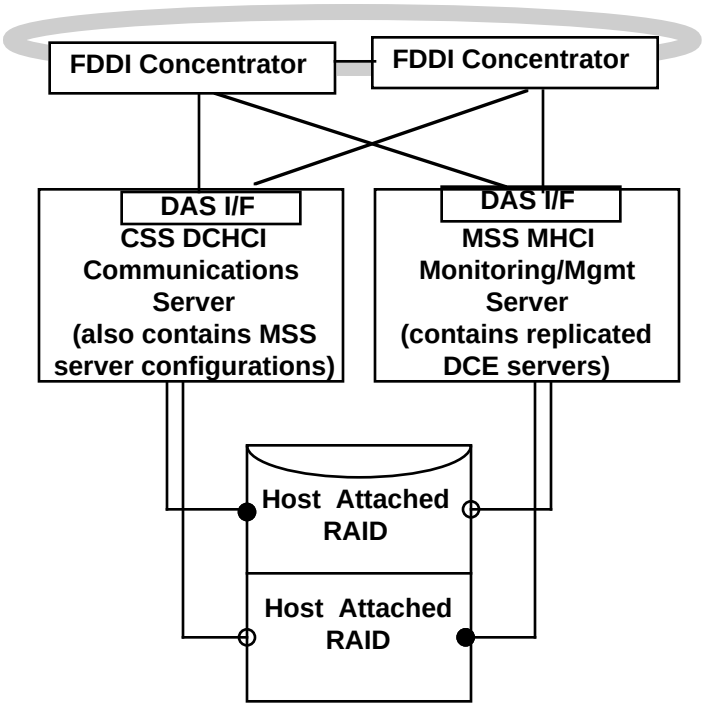

Figure 7.2-1. MSS / CSS Redundant Server Configuration